Anaerobic Digestion Feasibility Study

Surfside Wastewater Treatment Facility

Public Meeting

https://youtu.be/fF4ydI_uXxs

July 30, 2020

Agenda

- Project Team
- Review of Project Goals
- Review of Anaerobic Digestion
- Feasibility Methodology & Analysis
- Conceptual Design
- Schedule & Moving Forward
- Questions & Comments

CEC Project Team

- David Gray, Sewer Director, Nantucket
- Roberto Santamaria, Health Director, Nantucket
- Lauren Sinatra, Energy Coordinator, Nantucket
- Kent Nichols, Weston& Sampson
- Dan Sheahan, Weston & Sampson
- Gina Cortese, Weston & Sampson
- Representative from numerous Town Departments

MassCEC Assistance

- State economic development agency
- Mission: grow the state's clean energy economy while helping to meet the MA's clean energy, climate and economic development goals
- 2019 Organics-to-Energy grant for Feasibility Study: $60,000
- Public Outreach Support

Project Goals

- Determine Feasibility of AD Based on:
  - Feedstock Availability
  - Treatment Capacity
  - Energy Production
  - Waste Production
  - Financial Analysis
  - Evaluation of Project Site, Vicinity, and Community Impacts
  - Environmental and Permitting Consideration

- Anaerobic Digester Conceptual Design

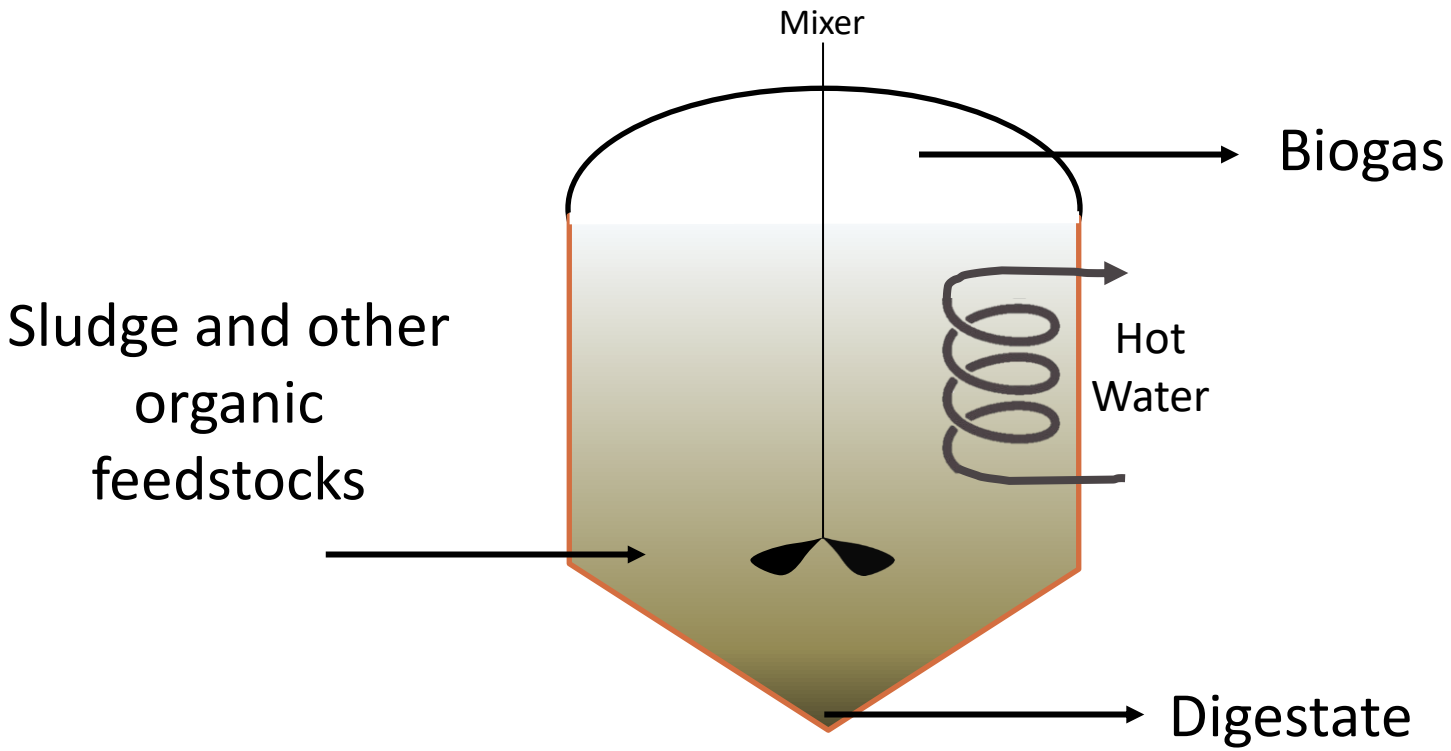
Anaerobic Digestion Benefits

1. Create sustainable energy source and cost savings for WWTF
2. Reduce volume of waste sent to Composter/ Landfill
3. Stabilize and increase nutrients in WWTF solids

Anaerobic Digestion Technology

- A collection of natural biologic processes.
- Microorganisms break down biodegradable material in the absence of oxygen.
- Process used in many industrial and domestic purposes to manage waste and/or to produce fuels.
- Digestate is produced by anaerobic digestion.

Anaerobic Digestion Technology



Anaerobic Digestion Technology
Feedstocks (Input)

- WWTF Residuals (Sludge/Bio-solids)
- Fats, Oils, and Grease
- Source Separated Organics
- Brewery Waste
- Other Wastes – Septage and Landfill Leachate

Feedstock Identification

- Identified possible feedstocks and volumes
- Data from WWTF & Landfill Records

Currently Received at Landfill	
Waste Name	Est. Ave. Annual Volume tons/yr
Municipal Solid Waste (MSW)/ Source Separated Organics (SSO)	575
Yard Waste	14,000
Animal Waste	180

Currently Available or Received by Truck at Surfside WWTF	
Waste Name	Est. Ave. Annual Volume gal/yr
FOG/ Grease Trap	8,900
Animal Grooming Trucks	165
Residential Tight Tank	336,000
Domestic Septage	1,760,000
Food Truck Waste	3,360
Equipment Cleaning Plant Water	165
Carpet Cleaner Waste	15,000
Industrial Wastes (Cisco)	133,000
Landfill Leachate	1,900,000
WWTF Sludge	2,330,000

Feedstock Identification

Currently Received at Landfill	
Waste Name	Est. Ave. Annual Volume tons/yr
Municipal Solid Waste (MSW)/ Source Separated Organics (SSO)	575

- Difficult to quantify portion of MSW/SSO available to digester
- First attempted to quantify all organic waste generators
  - Food Asset Network (2017 WPI)
  - Contact large, individual organic waste generators
    - Schools, grocery, hospital, farms, etc.
    - Positive, but inconclusive responses

Feedstock Identification

Currently Received at Landfill	
Waste Name	Est. Ave. Annual Volume tons/yr
Municipal Solid Waste (MSW)/ Source Separated Organics (SSO)	575

- Made estimation of digestible wastes present in MSW otherwise sent to Composter
- Assumptions:
  - 20% current MSW is digestible
  - 25% of digestible MSW could be reasonably diverted to WWTF
    - Commercial kitchens, grocery, etc.
- 575 tons/year of MSW/SSO

Feedstock Identification

- Characterized organic content of each
- Made recommendations

Waste Name	Estimated Average Annual Volume (liquid, gal/yr; solid, tons/yr)	Organic Content Strength (High, Moderate. Low)	Gas Production Potential (High, Moderate. Low)	Recommended as Feedstock? (Yes, No)
FOG/ Grease Trap	8,900*	High	High	Yes
Animal Grooming Trucks	165	Low	Low	No
Residential Tight Tank	336,000	Low	Low	No
Domestic Septage	1,760,000	Low	Low	No
Food Truck Waste	3,360	Low	Low	No
Equipment Cleaning Plant Water	165	Low	Low	No
Carpet Cleaner Waste	15,000	Low	Low	No
Industrial Wastes (Cisco)	133,000	High	Moderate/ High	Yes
Landfill Leachate	1,900,000	Low	Low/ Moderate	No
WWTF Sludge	2,334,000	High	Moderate/ High	Yes
MSW/ SSO	575	High	Moderate/ High	Yes
Yard Waste	14,000	Low	Low/ Moderate	No
Animal Waste	180	Low	Low/ Moderate	No

Electrical Energy Production

Source	Energy Yield (KWhr/yr)	Elec. Energy Value
Sewage Sludge	241,000	$69,000/year
Other Feedstocks	114,000	$33,000/year
Total	**355,000**	**$102,000/year**

- After Digester power loads are satisfied
- Available for WWTF demand offset
- Assumptions:
  - Approximate Elec. Energy Value @ $0.28/KWhr
  - Energy content of feedstocks from industry standards

Heat Production

Source	Energy Yield (MBTU/yr)	Equivalent Heating Oil	Cost Savings
Sewage Sludge	1,150	8230	$22,000
Other Feedstocks	540	3870	$10,000
Total	**1,690**	**12,100 gal/yr**	**$32,000/yr**

- After Digester heating is satisfied
- Available for WWTF building heating
- Assumptions:
  - Energy content of feedstocks from industry standards
  - Approximate Average $2.67/gal oil cost

Digestate & Biosolids

Feedstock Solids (High Season):

- Total Solids = 5,600 lbs/d
- Volatile Solids = 4,300lbs/d (78%)

Solids Destruction:

- Volatile Solids Destroyed = 2,500 lbs/d
  - 58% Volatile Solids destruction
  - 45% Total Solids destruction

Sludge Cake Solids Produced: 1,100 t/yr

Net Reduction in Sludge to the Composter: 320t/yr

  - 35%*

* Lower % reduction than TS destruction due to addition of outside feedstocks.

Impact to Surfside WWTF Process

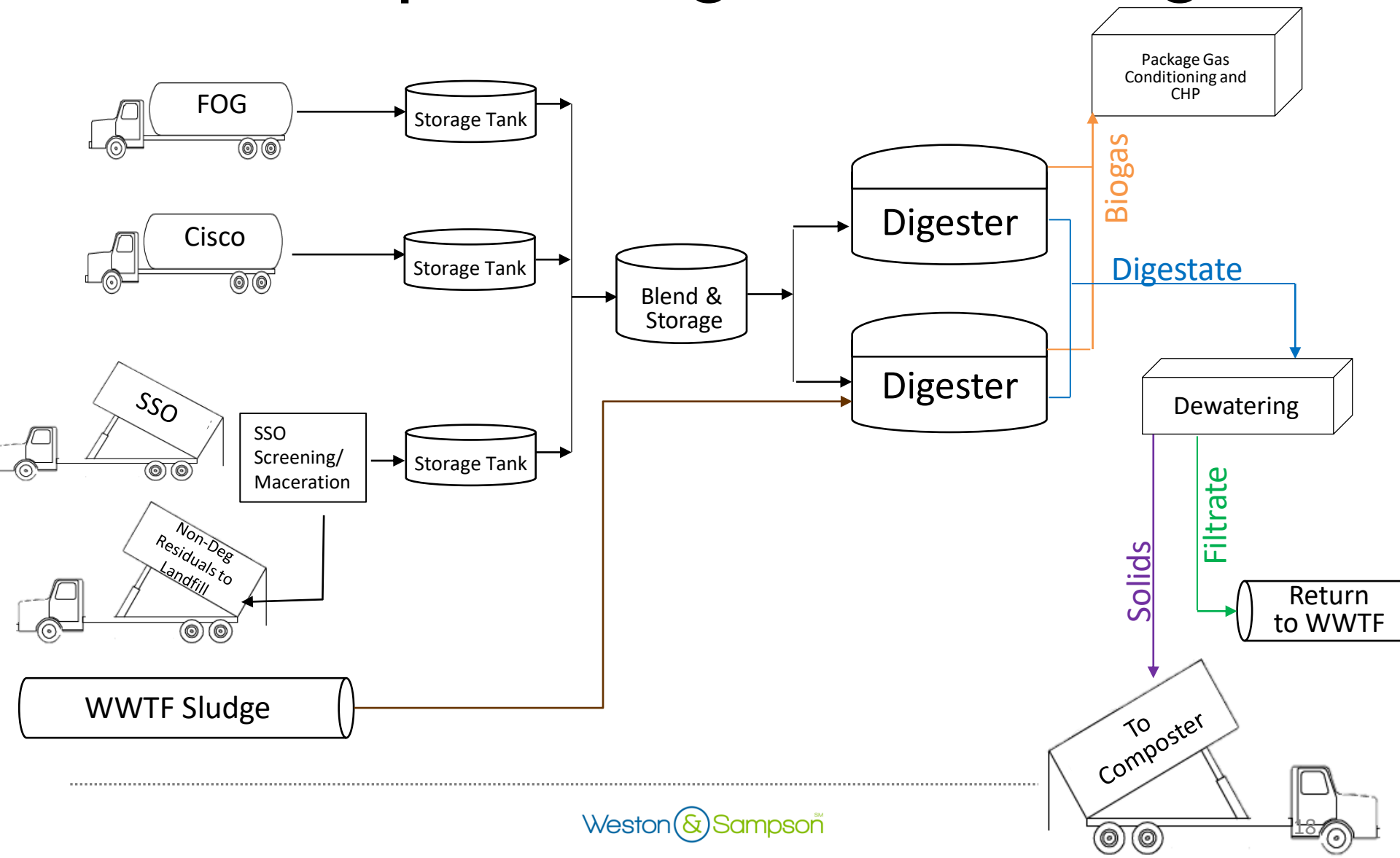
Digestate Liquid Returned to Influent

		High Season*	Low Season
Volume	(gpd)	10,000	5000
TSS	lb/d	155	75
	% increase in influent	4%	4%
NH3-N	lb/d	95	46
	% increase in influent	15%	15%

- Reduced Solids Dewatering time due to reduced solids to dewater after digestion.

* Plant currently at approximately 50% capacity during high season. Current Plant design capacity did not include digestate return load.

Conceptual Digestion Design



Gas Processing/ Co-Gen Systems

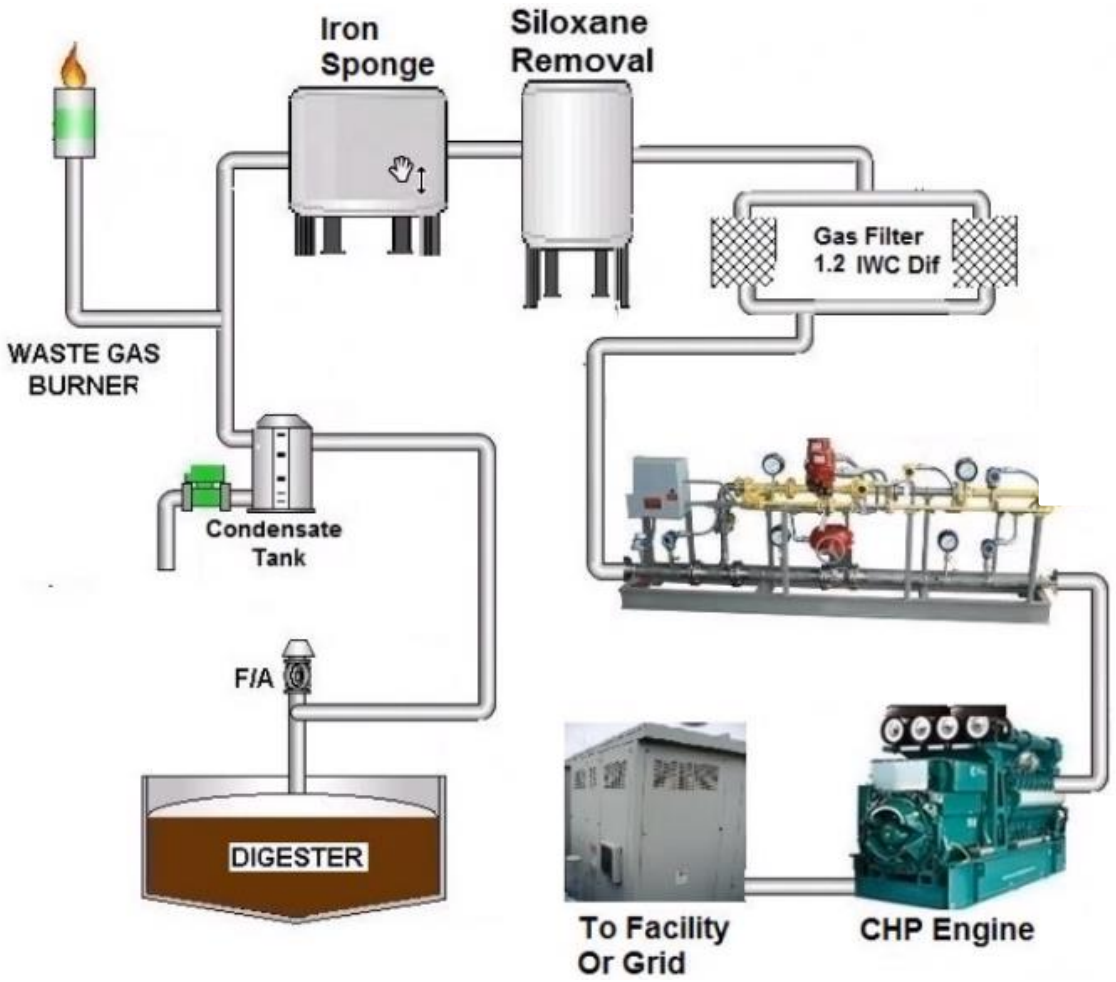


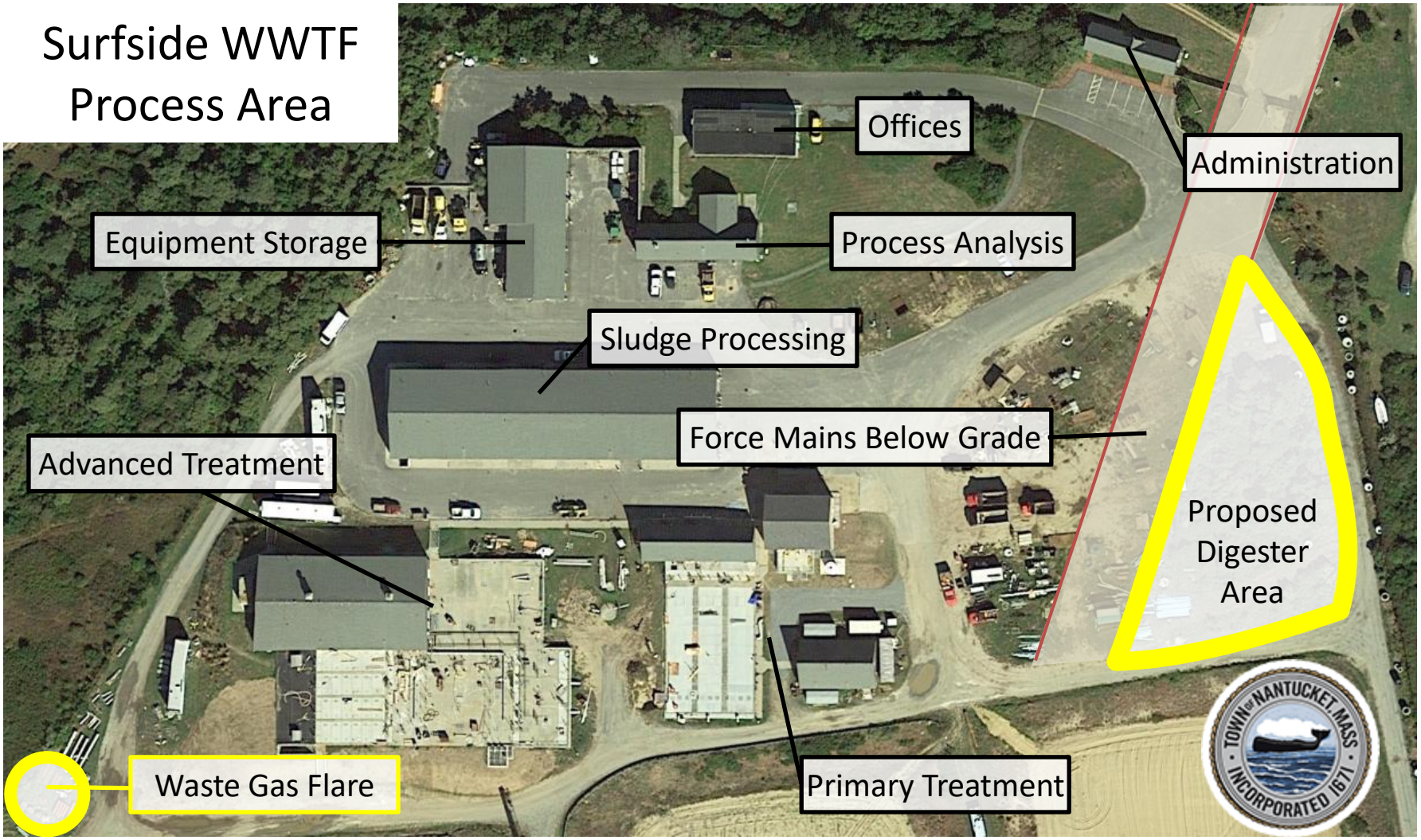
Figure from Water Environment Federation

Conceptual Design

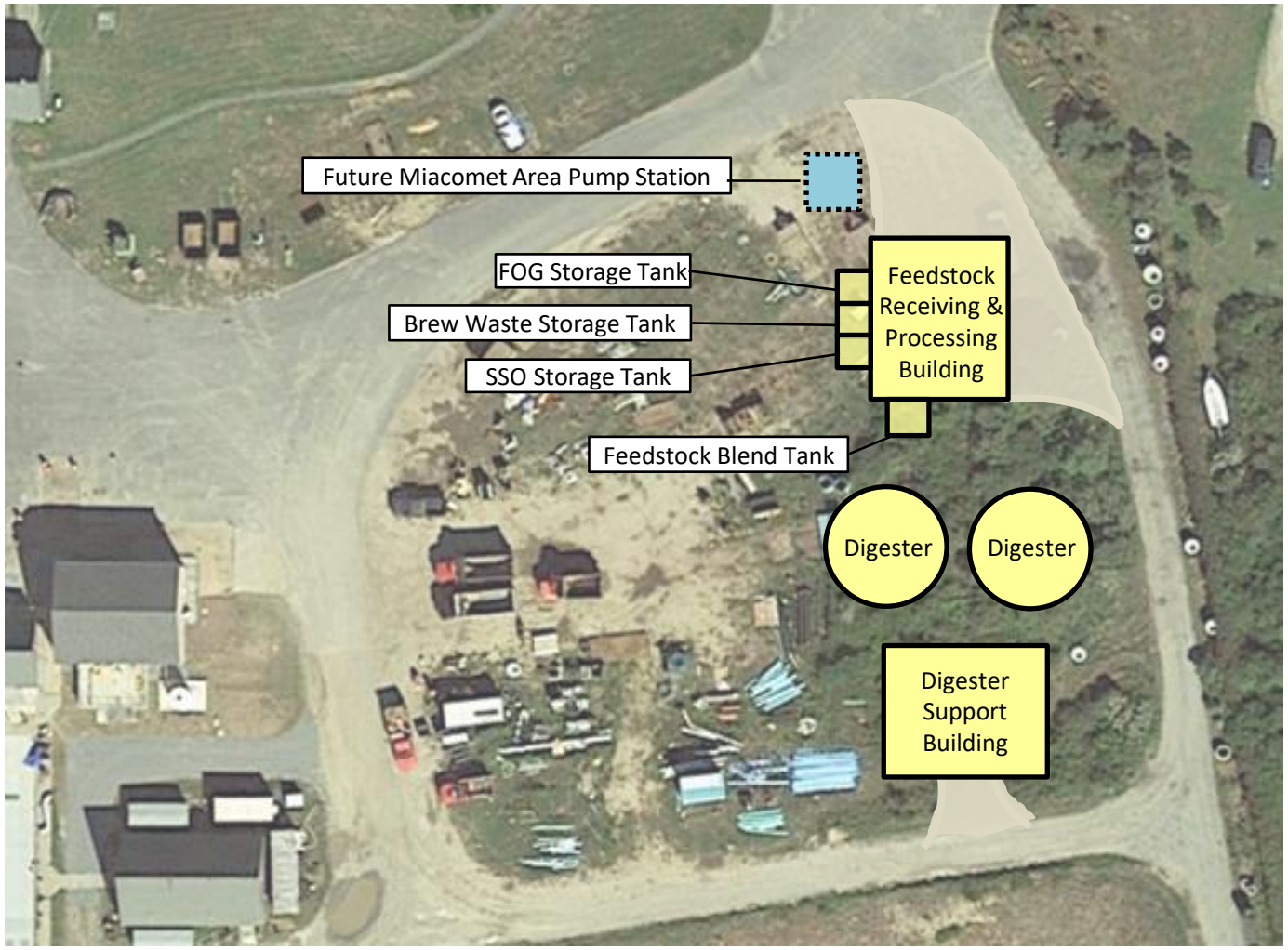
- Construction:
  - 2 Buildings – SSO Receiving and Processing Building & Digester Support Building
    - 2,000ft^2
    - Slab-on-grade
    - Single story
  - 3 Underground storage tanks – Feedstock Storage
    - 5000-gallon each
    - Precast concrete
    - FOG, Brew Waste, SSO
  - 1 Underground storage tank – Feedstock Blend Tank
    - 2000-gallon
    - Precast concrete
    - FOG, Brew Waste, SSO
  - 2 Digesters
    - 200,000-gallon each
    - 40ft D x 28ft H
  - Site Piping Modifications
  - Site Work (associated pavement, piping, earthwork etc.)

Conceptual Design

Conceptual Design



Conceptual Design



Anaerobic Digestion Technology

Burlington, VT

Conceptual Design Costs

Description	Approximate Cost Low	High
General Conditions	$1,433,000	$1,911,000
Site Work	$814,000	$1,085,000
Concrete	$825,000	$1,100,000
Buildings	$2,759,000	$3,678,000
Process Equipment	$3,179,000	$4,238,000
Exterior Finishes & Equip.	$195,000	$262,000
Controls & Instrumentation	$185,000	$246,000
Total Capital Cost	**$9,390,000**	**$12,520,000**
Engineering & Permitting	$2,160,000	$2,880,000
Planning Contingency (30%)	$3,465,000	$4,620,000
Total	**$15M**	**$20M**

Conceptual Design Costs

	Approximate Cost	
Description	Low	High
Total Opinion of Project Cost	$15,000,000	$20,000,000
Anticipated Annual O&M Cost	$300,000	$400,000
Amortized Capital Cost	$870,000	$1,160,000
Equivalent Uniform Annual Cost	**$1,170,000**	**$1,560,000**
(Approx. Annual Cost of Ownership)		

Financial Analysis

- Conceptual Level Capital Cost - $15M - $20M
- Equivalent Uniform Annual Cost: $1.2M - $1.6M
- O&M Costs
  - Labor and Parts
  - Likely Energy Neutral
    - excess heat and power will support ancillary structure heating and lights and possibly some WWTP supplement
- Savings
  - Sludge Disposal At Landfill (@$83.53/t)
    - $25,000 annually*
  - Excess Heat and Power Use
    - $84,000 excess energy annually
    - $32,000 heating oil cost savings annually

* Assumes composter currently achieves approx. 30% Sludge VS destruction (approx. 50% of AD digester reduction).

Financial Analysis

Possible Revenues

- Renewable Energy Credits
- Alternative Energy Credits
- Feedstock Tipping Fees
- Biosolids Product

Funding Sources

- Low Interest Loans SRF
- SRF Grants
- Green Energy Grants
- Organics-to-Energy Grants
- Other Grants (TBD)

Evaluation Criteria

- Evaluation Criteria & Importance
  - Capital Cost
  - Cost Savings/Revenue Generation Potential
  - Impacts to Neighbors (Visual & Odor potential)
  - Operational Complexity
  - WWTF Site Impacts
  - Landfill Life
  - Composter Impacts
  - Sensitive Environmental Receptors
  - Environmental Stewardship

Schedule

Completed:

- Kick-Off Meeting with Project Team: November 21, 2019
- Community Engagement Report: December 15, 2019
- Initial Public Meeting: February 4, 2020
- Internal Update Call: March 3, 2020
- 2nd Internal Update Call: July 13, 2020
- Second Public Meeting: July 30, 2020

Remaining:

- Draft Feasibility Study: August 30, 2020
- Final Feasibility Study: October 30, 2020

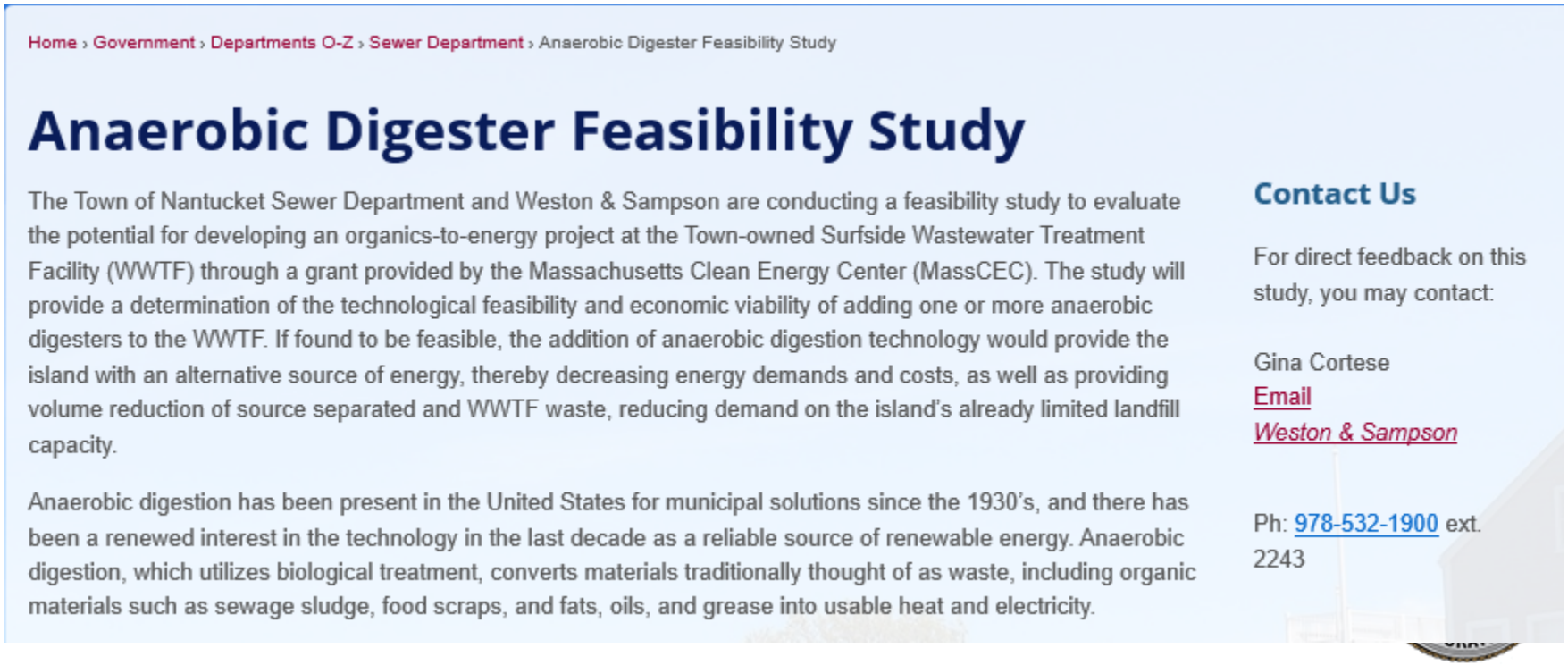
Moving Forward

- Complete Draft Report & Address Public Comments
- Town Review of Draft
- MassCEC Review of Draft
- Complete Final Report

Questions & Comments

- Receipt by August 13, 2020
- Project Page of Nantucket Town Website

https://www.nantucket-ma.gov/1616/Anaerobic-Digester-Feasibility-Study



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Anaerobic Digester Feasibility Study

The Town of Nantucket Sewer Department and Weston & Sampson are conducting a feasibility study to evaluate the potential for developing an organics-to-energy project at the Town-owned Surfside Wastewater Treatment Facility (WWTF) through a grant provided by the Massachusetts Clean Energy Center (MassCEC). The study will provide a determination of the technological feasibility and economic viability of adding one or more anaerobic digesters to the WWTF. If found to be feasible, the addition of anaerobic digestion technology would provide the island with an alternative source of energy, thereby decreasing energy demands and costs, as well as providing volume reduction of source separated and WWTF waste, reducing demand on the island's already limited landfill capacity.

Anaerobic digestion has been present in the United States for municipal solutions since the 1930's, and there has been a renewed interest in the technology in the last decade as a reliable source of renewable energy. Anaerobic digestion, which utilizes biological treatment, converts materials traditionally thought of as waste, including organic materials such as sewage sludge, food scraps, and fats, oils, and grease into usable heat and electricity.

Contact Us

For direct feedback on this study, you may contact:

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thank you